



# **NATIONAL TRANSPORTATION SAFETY BOARD**

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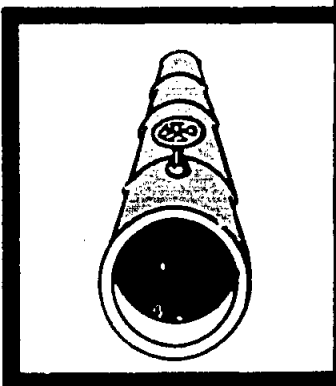
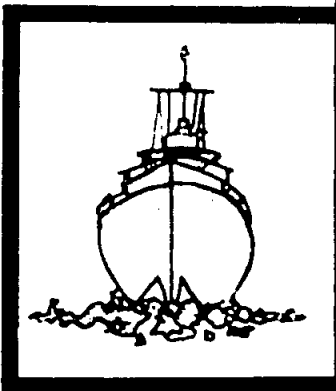
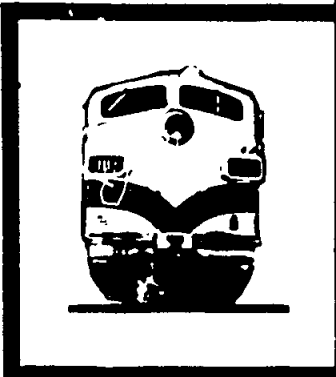
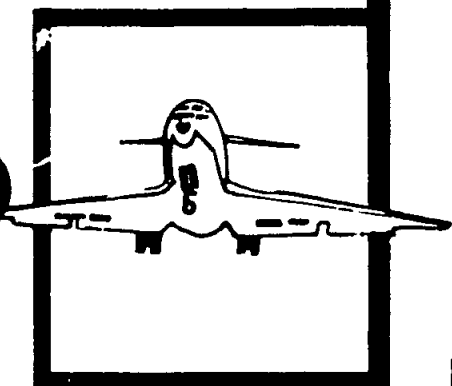
## **HIGHWAY ACCIDENT REPORT**

**FORD CONSTRUCTION COMPANY  
TRUCK—SEMITRAILER/DODGE VAN COLLISION  
MARION, NORTH CAROLINA  
MAY 12, 1977**

**REPORT NUMBER: NTSB-HAR-78-3**

**UNITED STATES GOVERNMENT**

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| <p>16. Abstract About 4:00 p.m. e.d.t., on May 12, 1977, a partially loaded flatbed truck, towing a flatbed utility semitrailer fully loaded with a loader-backhoe tractor, was descending a curved, steep, long grade near Marion, North Carolina, when the combination vehicle suddenly began to accelerate.</p> <p>The truck-semitrailer remained on the roadway for about 1/3 of a mile and was negotiating a curve when it skidded sideways; the semitrailer crossed into the opposing traffic lane. The loader-backhoe tractor broke free of its restraining chains and vaulted to the roadway into the path of an oncoming van. The truck-semitrailer continued ahead, left the road, and struck a tree. Five occupants of the van were killed and two were critically injured. The truckdriver was not injured; a passenger in the truck received minor injuries.</p> <p>The National Transportation Safety Board determines that the probable cause of this accident was the loss of braking effectiveness which permitted the truck-semi-trailer to accelerate out-of-control down a long, steep grade. The loss of braking effectiveness was caused by inoperative brakes on the semitrailer, which resulted from inept and inadequate maintenance and by the operation of this unsafe vehicle.</p> |   |  |           |
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NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C.

HIGHWAY ACCIDENT REPORT

Adopted: May 4, 1978

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FORD CONSTRUCTION COMPANY TRUCK-SEMITRAILER/  
DODGE VAN COLLISION  
MARION, NORTH CAROLINA  
MAY 12, 1977

SYNOPSIS

About 4:00 p.m. e.d.t., on May 12, 1977, a partially loaded flatbed truck, towing a flatbed utility semitrailer fully loaded with a loader-backhoe tractor, was descending a curved, steep, long grade near Marion, North Carolina, when the combination vehicle suddenly began to accelerate.

The truck-semitrailer remained on the roadway for about 1/3 of a mile and was negotiating a curve when it skidded sideways; the semitrailer crossed into the opposing traffic lane. The loader-backhoe tractor broke free of its restraining chains and vaulted to the roadway into the path of an oncoming van. The truck-semitrailer continued ahead, left the road, and struck a tree. Five occupants of the van were killed and two were critically injured. The truckdriver was not injured; a passenger in the truck received minor injuries.

The National Transportation Safety Board determines that the probable cause of this accident was the loss of braking effectiveness which permitted the truck-semitrailer to accelerate out-of-control down a long, steep grade. The loss of braking effectiveness was caused by inoperative brakes on the semitrailer, which resulted from inept and inadequate maintenance and by the operation of this unsafe vehicle.

INVESTIGATION

The Accident

About 4:00 p.m. e.d.t., on May 12, 1977, a flatbed truck owned by the Ford Construction Company of Selma, Alabama, was traveling south on U.S. Highway 221 about 20 miles north of Marion, North Carolina. The truck was partially loaded with construction equipment and was towing a flatbed utility semitrailer, which was fully loaded with a loader-backhoe tractor. The truck was occupied by a driver and a fellow workman who was dozing and, therefore, could not relate what occurred. The truck began to descend a steep 4-mile-long grade followed by another Ford Construction Company pickup truck driven by a construction foreman.

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The flatbed truckdriver reported that he started down the grade with the truck transmission in second gear and the 2-speed rear axle in low range. Two automobiles caught up to the trucks about 1 mile down the grade and 1 mile before the highway widened from two to four lanes for passing. (See figure 1.) The first automobile driver reported that she was traveling about 35 mph before catching up to the trucks and followed behind at 30 to 35 mph while waiting for an opportunity to pass. The second automobile driver reported that she was traveling about 30 to 35 mph before catching up to the vehicles ahead and slowed to about 25 mph so that she would not follow too close. The distance between her vehicle and the vehicles ahead increased gradually as she slowed.

Both automobiles passed only the pickup truck in the 4-lane section of highway, and both drivers began to smell an odor they associated with overheated brakes just after passing the pickup truck. Their speed and the flatbed truck's speed remained constant, at 30 to 35 mph, as they followed closely behind the truck for about 1 mile and waited for the next passing zone. The first automobile driver began to pass the truck when they reached the next passing zone, but the truck's speed began to noticeably increase. Because of the increased speed and the smell of burning brakes, she decided that the truckdriver was having problems controlling his vehicle so she did not complete the passing maneuver. She estimated that the truck achieved a speed of about 45 to 50 mph as it pulled away and disappeared around a curve. Neither automobile driver remembered hearing any unusual noises or seeing brakelights as they followed behind the truck.

The flatbed truckdriver and the pickup truckdriver reported that they had traveled from the top of the grade to beyond the 4-lane section of highway at a constant speed of about 20 mph. After he had traveled through this 4-lane section and was on a steeper section of the grade, the flatbed truckdriver said he heard "something rattling underneath the truck and it wasn't too long after the noise started that the truck began to pick up speed." The pickup truckdriver also heard a noise he associated with the truck ahead even though the two cars were between them by then, and the truck was not in sight because of a curve. To him, the noise "sounded like a 2-speeder squealing sound, just a regular chattering ...," as though an attempt was being made to engage the rear axle, but it was not engaging.

The flatbed truckdriver said he applied the brake pedal as hard as he could when the truck began to accelerate. He did not hear the tires squeal, and the brakes did not seem to slow the truck. He then applied the parking brake, but this did not seem to affect the truck's operation. He reported that he did not shift the transmission or rear axle controls at any time during the descent.

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The truck remained on the roadway for about 1/3 of a mile. When the truckdriver attempted to negotiate a series of curves, the truck and semitrailer skidded sideways on a curve to the right and the semitrailer crossed into the northbound lane. A witness sitting near the curve estimated that the truck was traveling about 60 mph as it approached this curve. At that moment, a van with seven occupants approached in the northbound lane. As the driver of the van applied his brakes, the loader-backhoe tractor broke free of its restraining chains and vaulted into the oncoming van.

The collision immediately reversed the forward motion of the van, which rolled over onto its left side, rotated 180°, and moved rearward 76 feet. The loader-backhoe tractor disengaged from the van and veered diagonally across the southbound lane where it struck a large tree. The truck, with the semitrailer still connected, continued ahead 165 feet and crossed the road. It vaulted a 5-foot-wide ditch, struck and rotated around a tree, and rolled onto its left side.

The truckdriver and the passenger extricated themselves from the cab of the truck without assistance; the truckdriver was not injured, but the passenger sustained a slight shoulder injury. The driver of the van and four passengers were killed; one of these passengers was ejected from the right front seat onto the east shoulder. Two surviving passengers who occupied the bench seat immediately behind the driver were critically injured; one of these two survivors was seated on the right side of the van and was ejected onto the pavement a few feet south of the van. The remaining three passengers who were killed had occupied the other two bench seats and remained within the van. None of the van occupants was wearing the available seatbelts.

#### Injuries to Persons

| <u>Injuries</u> | <u>Drivers</u> | <u>Passengers</u> | <u>Other</u> |
|-----------------|----------------|-------------------|--------------|
| Fatal           | 1              | 4                 | 0            |
| Nonfatal        | 0              | 3                 | 0            |
| None            | 1              | 0                 | 0            |

#### Driver Information

The 38-year-old flatbed truckdriver had been employed about 12 years by the Ford Construction Company to drive trucks and work in construction. He held a valid Alabama driver's license which authorized him to operate the truck. He did not possess a medical certificate or a driver's daily logbook. Since the truck was being operated in interstate commerce, these items were required under Federal Motor Carrier Safety Regulations (FMCSR). The truckdriver and carrier/owner both stated that

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they were not aware of FMCSR requirements. No contact had ever been established with the carrier by the Bureau of Motor Carrier Safety (BMCS) of the Federal Highway Administration (FHWA) which is responsible for enforcing the FMCSR. The truckdriver's traffic record in Alabama for the past 7 years revealed no violations and one accident in which his automobile struck two parked cars while avoiding another car at an intersection.

The truckdriver was slightly familiar with the roadway and terrain near and at the accident site. On May 2, 1977, he had driven the truck over this same route from Selma, Alabama, to West Jefferson, North Carolina, a distance of 458 miles. He also had been a passenger in a vehicle which traveled round-trip through the area about 1 week before the accident. He had operated this truck for about 1 month; he had driven other company trucks of similar make and model. He was generally aware of the complexity of shifting the 2-speed rear axle and the problems that could be encountered in attempting to shift the rear axle while descending a steep grade.

On the day of the accident, he started work at 6:30 a.m. and spent most of the time preparing for the trip to Alabama. He departed West Jefferson about 2:30 p.m., stopped briefly to obtain a box lunch, and then drove about 58 miles before reaching the accident site.

No tests to determine alcohol or drug involvement were requested by the investigating police agency. According to the police, there was no physical evidence to warrant these tests. No charges were filed against the truckdriver by the State of North Carolina.

The 67-year-old van driver was employed by Anderson Junior College in South Carolina as a tennis coach. He was properly licensed by the State of South Carolina to operate the van; his traffic record revealed no accidents or violations. He was driving six members of the school tennis team to compete in a tournament in Banner Elk, North Carolina. They had departed from Anderson, South Carolina, in the afternoon and traveled about 140 miles before reaching the accident site.

#### Vehicle Information

The truck -- The truck was a 1977 General Motors 2-axle, flatbed truck with dual tires on each of the rear wheels. The gross vehicle weight rating of this truck was 19,200 pounds. It was equipped with an 8-cylinder, 350-hp gasoline engine, a CH 465 manual 4-speed transmission, a 6.50/8.85 vacuum-actuated 2-speed rear axle, a parking brake mounted on the end of the transmission output shaft, and a pintle hook for towing trailers. Governed engine speed for this engine in any gear was 4,000 rpm. For data concerning engine friction or engine braking capability and such braking factors as chassis friction, rolling resistance, and

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air resistance, see NTSB Public Docket SS-58-77. The truck's brake system was rated at 48 bhp per the Society of Automotive Engineers Standard SAE J880. SAE J-257 required about 39 bhp for this size vehicle. The odometer reading was 1,969 miles. Cargo on the truck consisted of wooden forms, a small gasoline pump, tools, and other similar supplies. The weight of this cargo and the truck was about 9,400 pounds.

The truck was damaged when it struck the tree; the truck did not contact the van. (See figure 2.) There was extensive damage to the left-front bumper and suspension system. The frame was bent and twisted and the rear section of the drive shaft was disengaged from the rear axle carrier at impact. The right-rear tires were flat. The right side of the rear axle had been forced rearward and the left side had been forced forward.

There was minimal wear to the brake linings on all four wheels. All of the linings were glazed and discolored. Some areas of the brake drums also were discolored. The brake backing plate and assemblies were thickly covered with lining wear residue. While this residue is normally produced from lining wear during braking, the amount of material present seemed excessive given the limited mileage on the truck. The brakes were in adjustment. A brake lining sample was analyzed by the manufacturer and the lining material was found to be within manufacturer's specifications. Tests indicated that the surface of the lining had been exposed to high operating temperatures conducive to brake fade. The linings of the parking brake assembly, designed to lock the drive shaft when the vehicle is parked, also appeared to have been overheated.

Considerable wear and burring were evident on the low-range teeth of the rear axle shift sleeve coupler. There was also wear on the low-range shift anchor teeth. Wear to a lesser degree was evident on the teeth of the high-range side of the coupler. The rear axle shifted smoothly when it was removed from the truck and bench-tested. The end of the plastic casement surrounding the steel cable that was connected between the 2-speed shift button in the cab and the vacuum control valve on the left side rail was found broken where it attached to the vacuum control valve. This observation was made after the cable and transmission had been disassembled from the truck. This break was attributed to the relative displacement of the cab and the vacuum control valve during the crash. Several gear teeth on the second gear of the transmission had shave marks or indentations which were thought to have been produced during manufacture; however, these did not affect the smooth rotation or operation of the gear train when it was manually manipulated. The engine of the truck was started and found to be in running condition up to operation of the governor.

About a month before the accident, the truck had been taken to a dealer for repair of an alleged problem with the 2-speed rear axle. Another truckdriver with the company had reported that he could not

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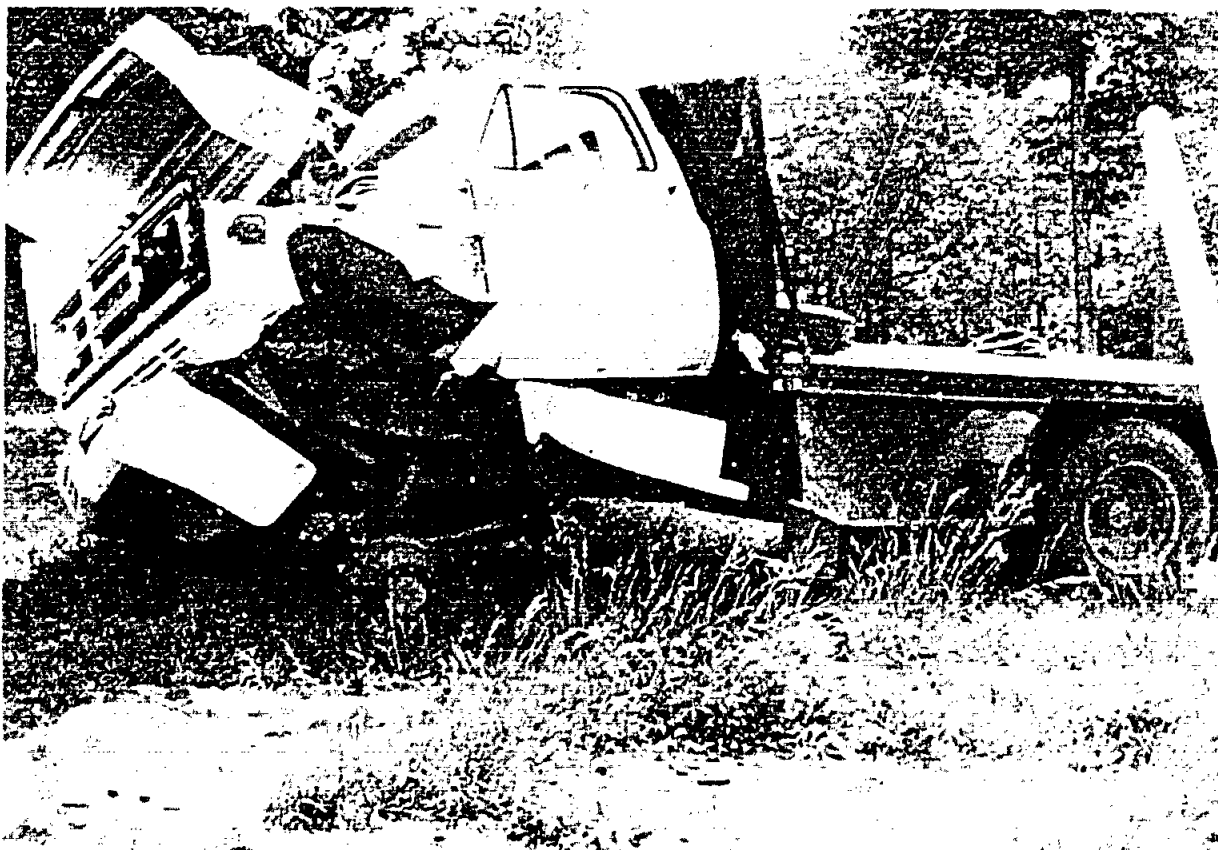


Figure 2. Truck involved in accident.

shift the rear axle from low to high range while the truck was moving. The dealer reported that rust was found on the teeth of the coupler, and that the unit functioned after the rust was removed. The truckdriver involved in this accident reported he had not experienced any problems in shifting the rear axle before his descent of the steep grade.

The semitrailer -- The utility semitrailer was a 2-axle, 4-wheel lowboy flatbed manufactured by Miller Tilt Top Trailer, Inc. (See figure 3.) It weighed 3,230 pounds and was rated for a maximum capacity of 22,000 pounds. It was equipped with a lunette eye-type towbar for towing by vehicles equipped with pintle hooks. It was designed for intermittent highway use at a maximum speed of 50 mph and was equipped with electrically-actuated brakes.

During the crash sequence, three of the four wheels of the semitrailer disengaged from their axles when struck by the loader-backhoe tractor as it fell off the trailer. Damage associated with contact by the loader-backhoe tractor was found along the inside sidewalls of the tires. The right-rear anchor bracket, used to anchor the restraining chain holding the rear of the loader-backhoe tractor in position, was torn from the semitrailer. The steel flanges around the semitrailer bed were bent, apparently from forces transferred through the restraining chains.

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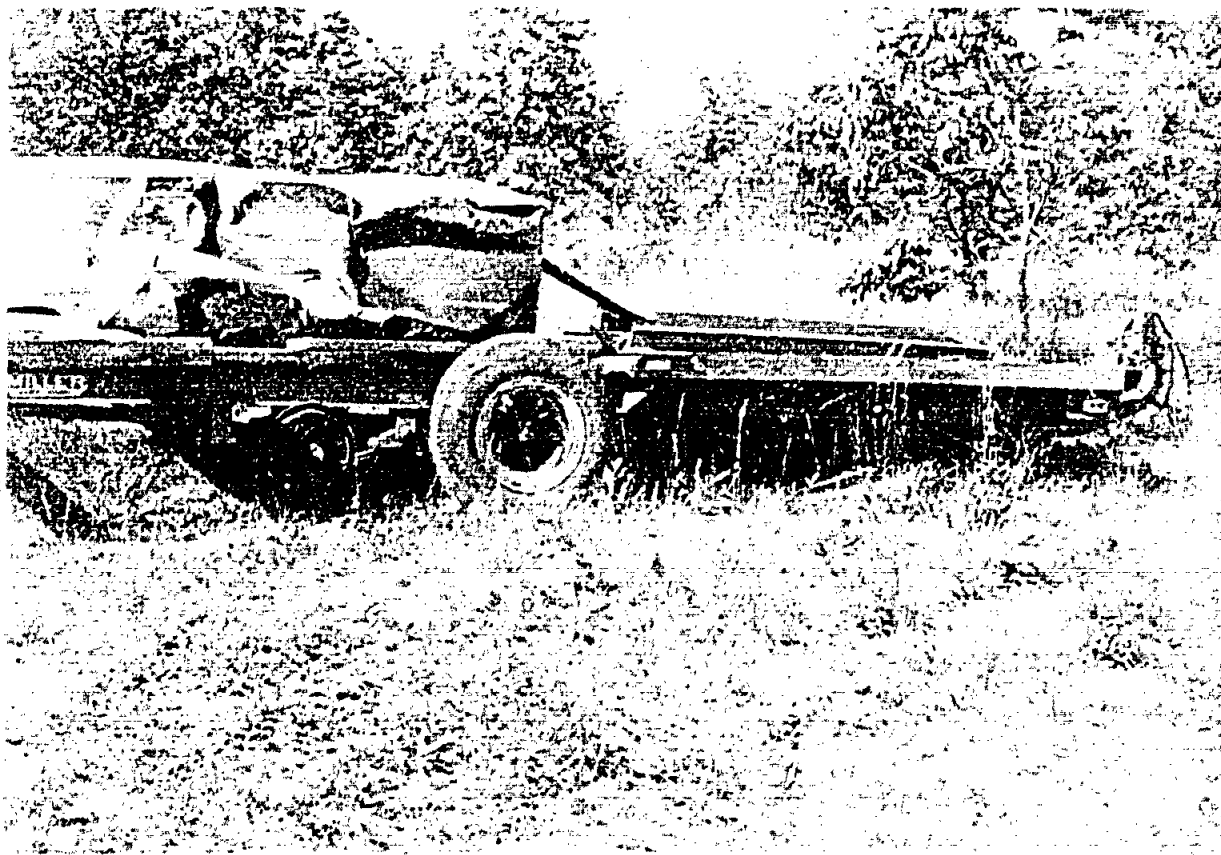


Figure 3. Semitrailer involved in accident.

The semitrailer's electric light wiring system was tested and found to be inoperative because its ground wire was connected to a rusty bolt. The electric circuit for actuating the brakes on the two right wheels was functional; however, the brakes on these right wheels were inoperative. The adjusting screw for the right front brake was found detached and loose in the drum. (See figure 4.) A bent nail had been inserted to hold the magnet in place; this nail protruded beyond the magnet, thereby preventing contact with the drum. (See figure 5.) The brake lining was in very poor condition. The right rear brake had functioned recently; this was indicated by abrasive wear from its magnet rubbing against the brake drum. However, testing revealed that the magnet had a restraining wire that prevented it from contacting the drum at the time of the accident. (See figure 6.)

The brakes on the two left wheels were missing. The electric wires for these two left wheels had been taped together. (See figure 7.) The flatted truckdriver involved in this accident stated that he had removed the left-front brake assembly while "repairing" a wheel malfunction about 2 months before the accident and did not replace it. Since this wheel had begun to wobble while he was towing the semitrailer, he removed the wheel, took it to a shop for replacement of the wheel bearings, and remounted the wheel. He knew the brakes for this wheel were not functional, but did not repair them because he "did not know how to repair brakes."

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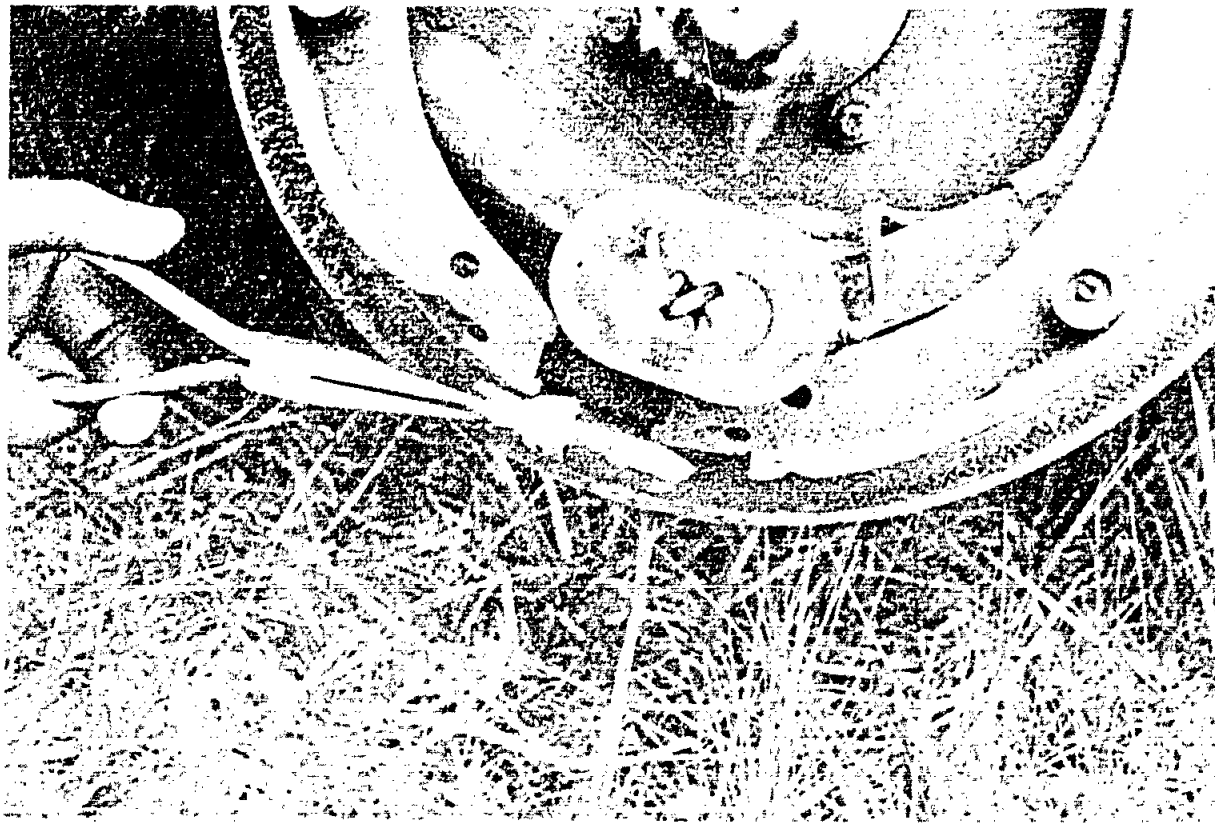


Figure 4. Right-front wheel of trailer. Note detached brake adjusting screw and wear from running loose inside the drum.

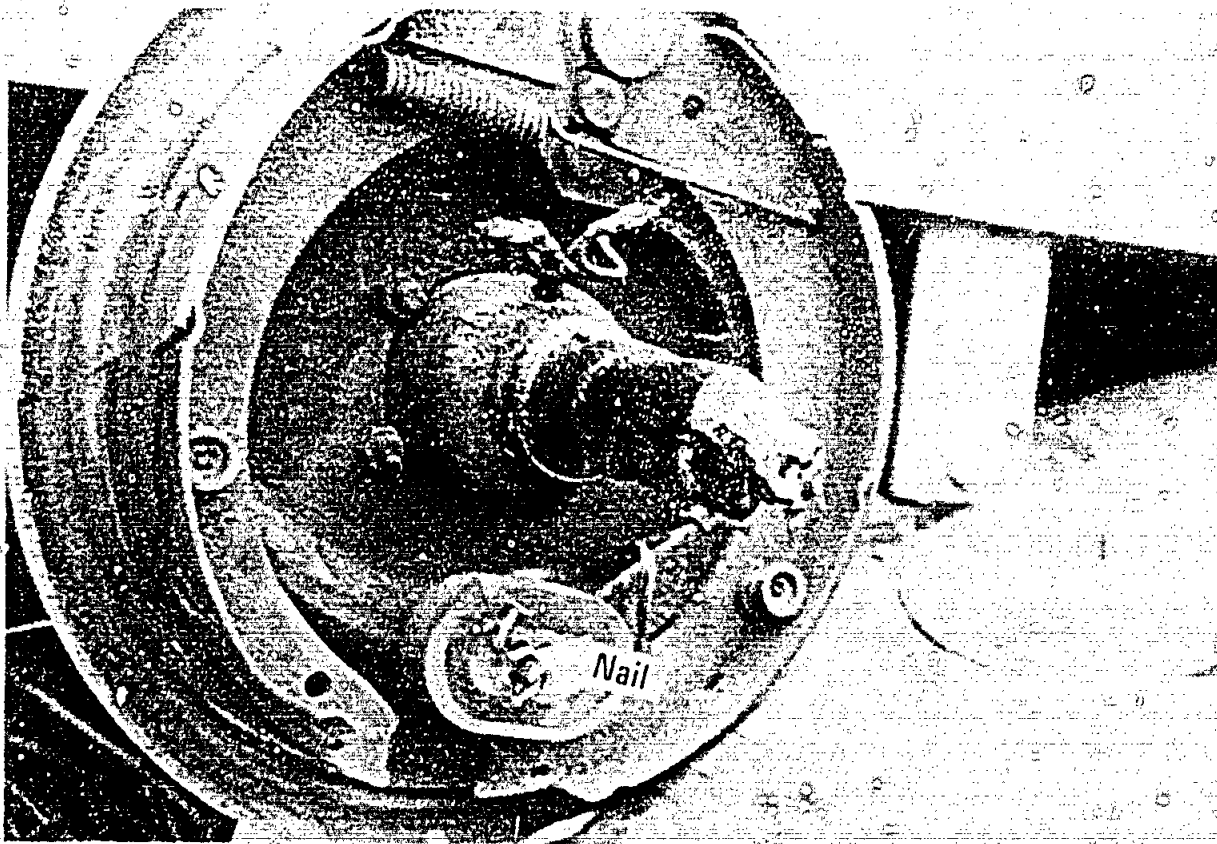


Figure 5. Right-front wheel of trailer. Note nail used to hold magnet in place. Lining condition may have been impact related.

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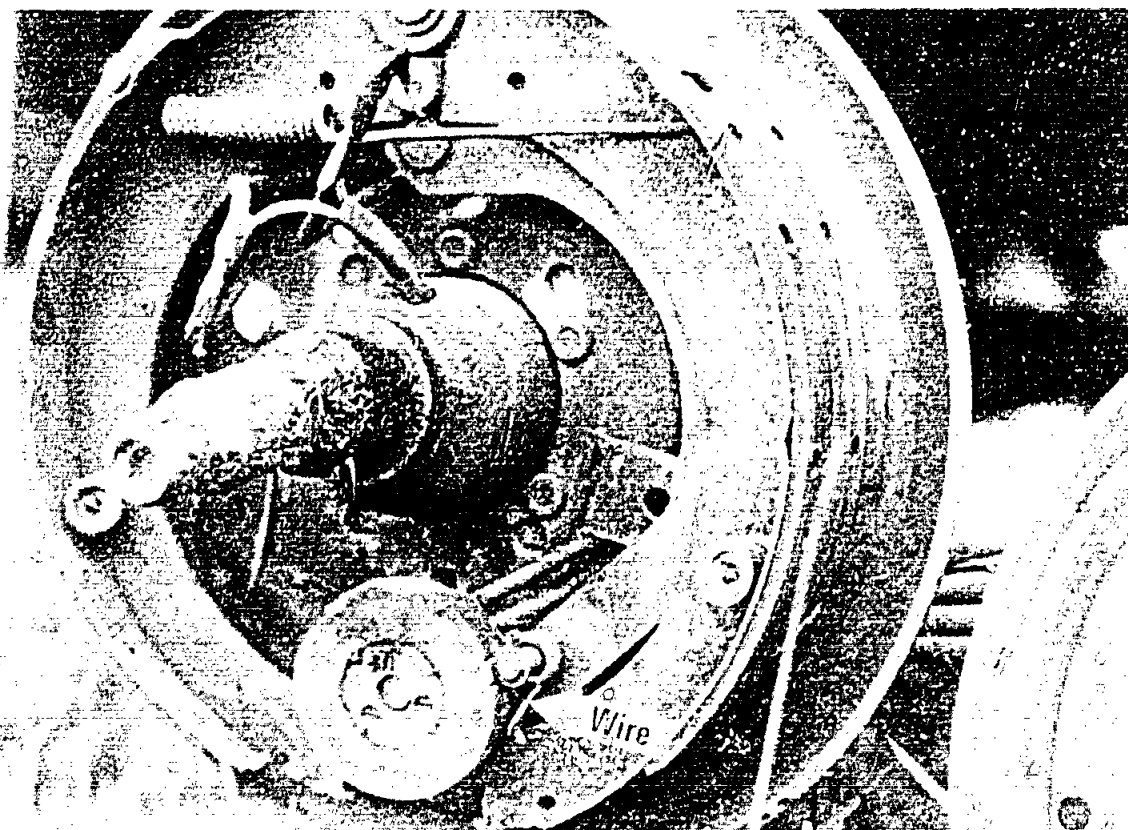


Figure 6. Right-rear wheel of trailer. Note wire used to hold magnet in place.

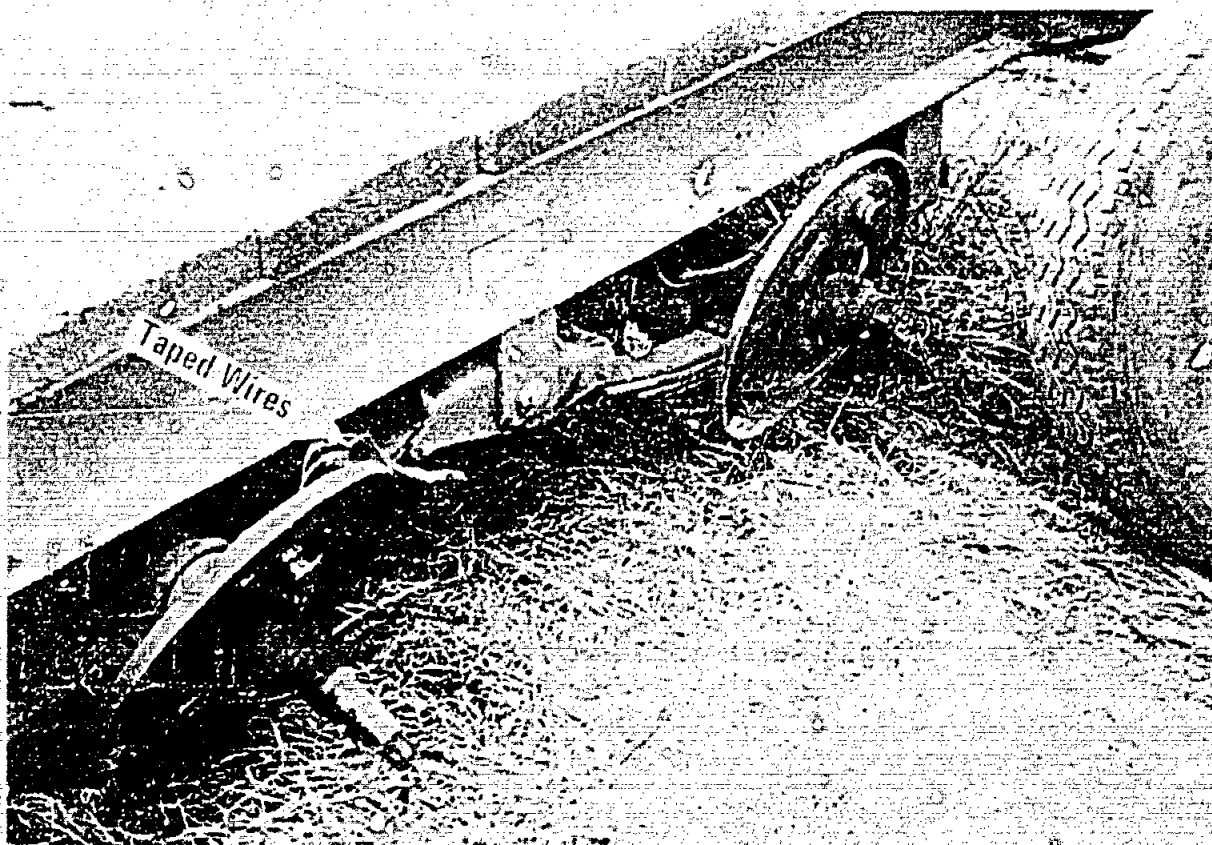


Figure 7. Left-front (foreground) and left-rear (background) wheels of trailer. Note lack of brake assemblies; wires to left-front had been taped.

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After the wheel was "repaired," the construction foreman who was driving the pickup truck that followed behind the flatbed truck had repacked the wheel bearings on all of the semitrailer wheels, a procedure that exposed all brake assemblies for inspection. He could recall the condition of the brakes on the wheel "repaired" by the truckdriver; he "wired" the magnet in place on one of the wheels and taped the wires that were not connected to brake assemblies. He said that it just didn't "dawn" on him what the consequences would be of operating the semitrailer without adequate brakes. The crew foreman did not advise company management about the condition of the semitrailer brakes. He did submit a bill for parts needed to repair the wheel bearings.

The loader-backhoe tractor -- The loader-backhoe tractor was a 1976 International Harvester tractor, Model 2514D, equipped with a hydraulic front-end loader and a rear boom with bucket. (See figure 8.) The unit weighed about 11,310 pounds with a weight distribution of 2,000 pounds on the front axle and 9,310 pounds on the rear axle when being transported. It was being transported with its rear end forward, which was an appropriate loading configuration.

According to company personnel, the loader-backhoe tractor was secured to the semitrailer with two chains. One chain each bound the front and rear of the unit. Chain binders were used to tighten both chains. The chains were about 20 feet long and had links made from 3/8-inch-diameter, high tensile strength steel. It was not possible to locate or positively identify all components associated with holding the unit in place on the semitrailer and their condition after the accident. Therefore, no precise description of how the loader-backhoe tractor broke free of the semitrailer could be established.

The van -- The van was a 1973 Dodge Maxivan. It had 4 wheels with hydraulic brakes. In addition to the driver's door and rightside door, the van was equipped with rear rightside hinged doors, hinged rear doors, and three bench seats behind the driver and front passenger seat. Damage to the van was extensive. (See figure 9.)

#### Roadway Information

U.S. Highway 221 is a north-south highway through mountainous terrain near the accident site. The roadway was primarily 20 feet wide with two asphalt-paved lanes bordered by earth shoulders of varying widths. The slope of the roadway varied between 5 to 8 percent and was steepest for the longest distance at the bottom of the grade. At the top of the mountain, there were two advisory signs with legends stating "Hill--Trucks Use Low Gear--Next 4 Miles." The highway speed limit for descending traffic was posted for 35 mph. Numerous curve warning signs were located along the roadway throughout the downgrade. The truckdriver did not recall the speed limit on the hill; he did recall seeing a hill sign at the summit advising the use of low gears.

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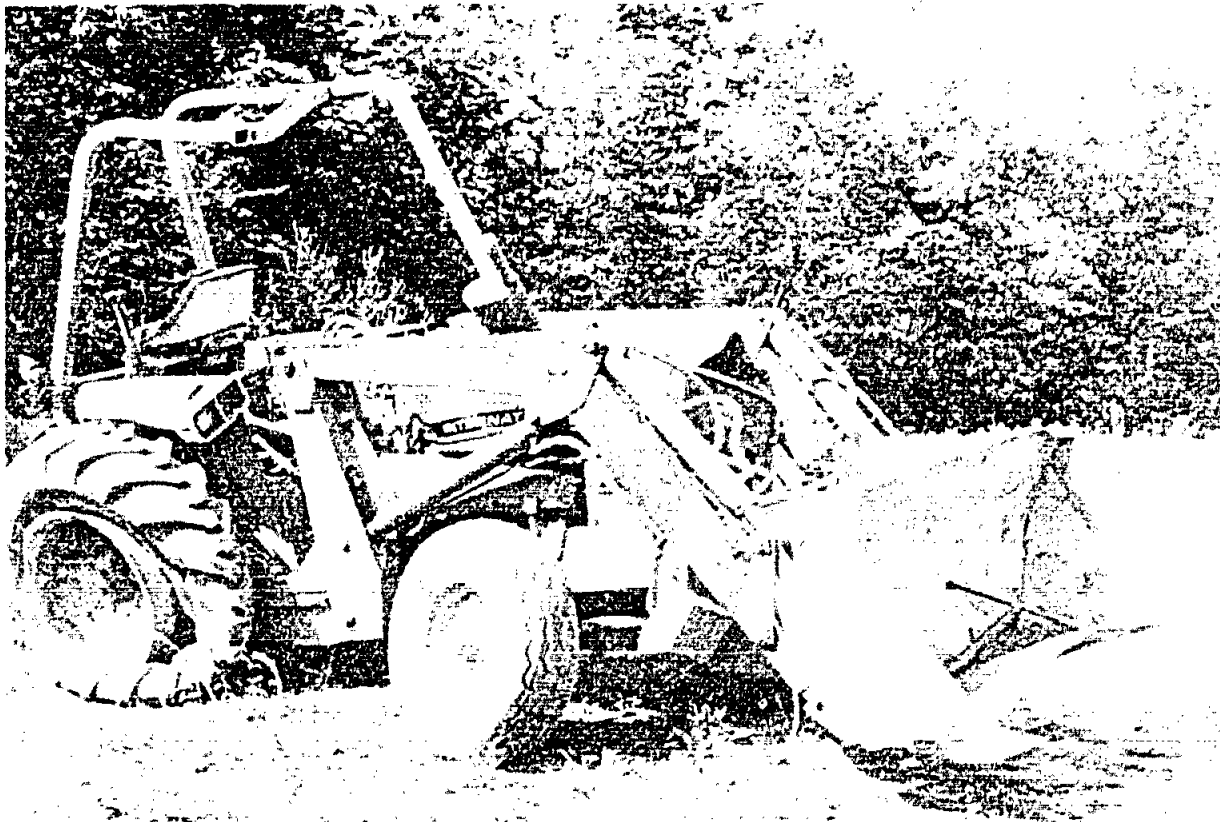


Figure 8. Backhoe involved in accident.

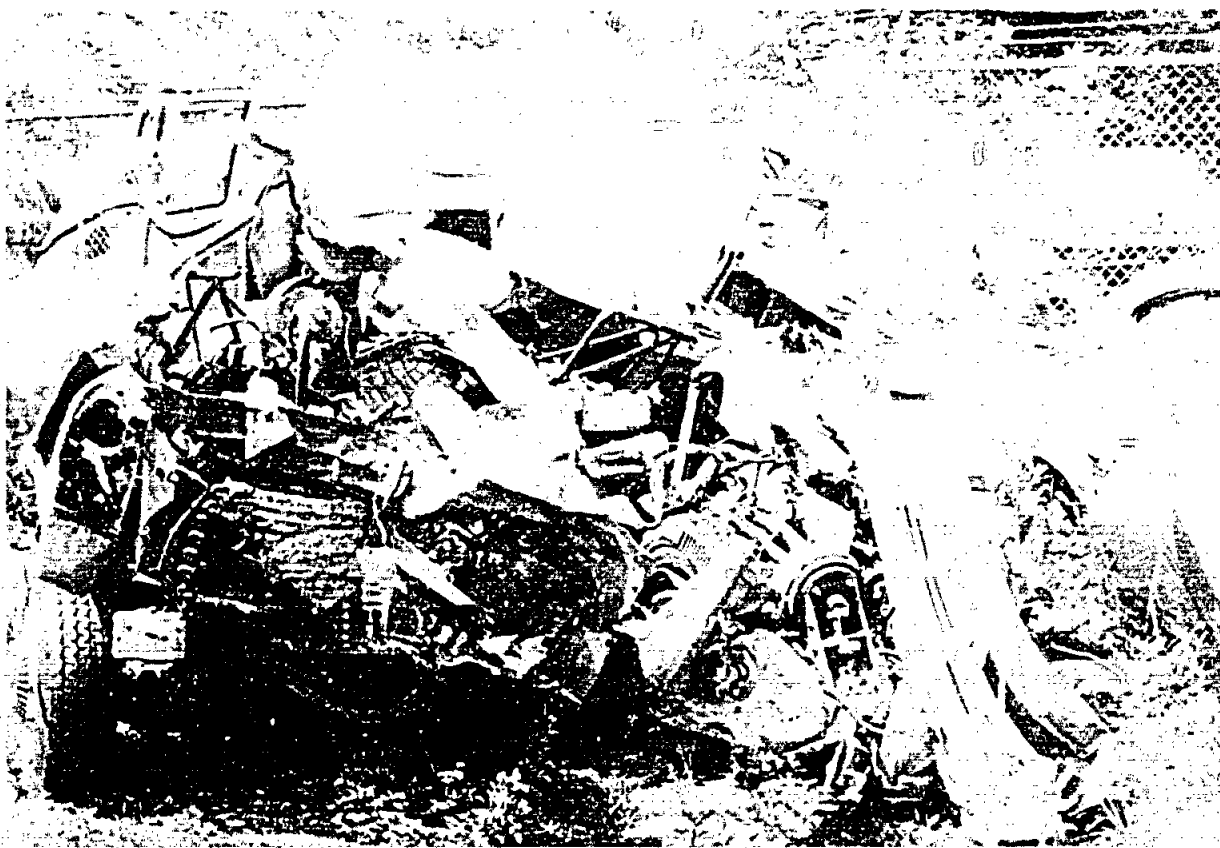


Figure 9. Van involved in accident.

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A 4-lane, 1,300-foot-long section of highway began about 2 miles south of the summit to provide for a passing area. A graphic sign with a truck profile pictured descending a grade along with a message, "Trucks Use Lower Gear," was posted at the beginning of the 4-lane section of highway. The truck began its uncontrolled descent about 1 mile below the 4-lane section. It negotiated a curve to the right, then a curve to the left, and was attempting to negotiate a curve to the right when the accident occurred. This third curve was a 14° curve and had 0.08 feet per foot superelevation. It had been widened to provide a 23-foot roadway.

There were no escape routes provided for out-of-control vehicles. An escape route is any existing or purposely constructed off-road feature that could be easily detected, approached at high speed and at a shallow entry angle, and which would have some restraining quality that would be sufficient to stop and contain an out-of-control vehicle.

The average daily traffic volume was about 2,000 vehicles. A total of 24 accidents occurred on this grade from 1974 through 1976. Thirteen persons were injured and one person was killed in these accidents. Only one other accident involved a truck that lost its brakes.

#### Meteorological Information

The roadway was dry, the weather was clear and sunny, and visibility was good.

#### Other Information

The State of Alabama had no compulsory or random inspection program for motor vehicles or trailers at the time of this accident. The construction company had no formal preventive maintenance or periodic vehicle inspection program. Because company equipment was predominately en route to and from a job site or at a job site, the company construction foremen were made responsible for insuring that equipment was in adequate condition and that proper repairs were made. After the accident, the BMCS surveyed the construction company's operation. This survey revealed that no compliance with any regulation applicable to preventing this accident had been effected by the company. The following violations of the Federal Motor Carrier Safety Regulations were particularly applicable to this accident:

391.41(a) Driver - Failing to have on his person a Medical Examiner's Certificate.

391.11(b)(8) Driver - Failing to furnish employer a list of traffic violations or certificate each 12 months as required by section 391.27.

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- 391.45(a) Driver - Failing to be medically examined.
- 392.7 Driver - Failing to inspect vehicle to assure all brakes were operating before driving.
- 393.14 Trailer - Operating a vehicle without all operable lamps and reflectors as required.
- 393.42 Trailer - Operating a vehicle without brakes installed on all wheels.
- 393.48 Trailer - Operating a vehicle without operative brakes on all wheels.
- 393.4 Driver - Operating a motor vehicle that, by reason of its mechanical condition, is imminently hazardous to operate as to cause an accident or a breakdown of the vehicle.
- 395.8 Driver - Failing to prepare a daily log.
- 396.2 Carrier - Failure to systematically inspect and maintain, or cause to be systematically maintained, all motor vehicles under its control.
- 396.2 Carrier - Failure to maintain systematic inspection and maintenance records.
- 396.4 Carrier - No motor carrier shall permit or require a driver to drive any motor vehicle revealed by inspection or operation to be hazardous or likely to result in a breakdown of the vehicle.

The company advised BMCS that a program would be established to correct these deficiencies and insure compliance with the FMCSR.

#### ANALYSIS

The Safety Board's investigation revealed that the accident was caused by the truckdriver's inability to control the speed of his vehicle while descending a grade because the semitrailer brakes were inoperative. The Safety Board's analysis of the evidence will refute the truckdriver's claim that he was operating in the second-low gear setting, a setting which would have compensated for the lack of semitrailer brakes. The analysis will also refute the truckdriver's claim that some element of the truck's driveline disengaged by itself and thereby produced the loss of speed control. Therefore, the safety issues which must be analyzed are: (1) Inadequate company maintenance procedures and inspection

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programs which permitted the vehicle to be operated on the highway, and (2) highway-related improvements that, although not related to cause, have the potential to reduce the severity of this type of accident.

#### The Accident

Without semitrailer brakes, only the truck brakes, truck engine, and such factors as chassis friction, rolling resistance, and air resistance were available to slow the combination vehicle. The truck brakes, truck engine, and all other truck components were designed for the truck's gross vehicle weight rating of 19,200 pounds. Because the loaded weight of the truck was about 9,400 pounds, the truck brakes and engine, theoretically, could have provided stopping power for any additional load up to 9,800 pounds during the descent. The semitrailer with its loader-backhoe tractor cargo weighed about 14,600 pounds; this weight exceeded the additional load limit by 4,800 pounds. This excessive weight on the truck brakes seriously degraded the truckdriver's ability to descend the grade in a normally acceptable gear setting. If held in reserve, the truck brakes alone could have stopped both the truck and semitrailer even with the excessive weight. However, if used continuously for speed control, which would have been necessary to descend the grade in a normally acceptable gear setting, the truck brakes would have faded and could not have stopped the combination vehicle.

If certain lower-than-normal gear settings had been used to descend the grade, the truck engine would have provided additional braking force, and the truck brakes would not have been used for speed control. The truckdriver claimed to have been operating in such a gear setting -- second-low range. <sup>1/</sup> The evidence of overheated brakes indicated that the truck brakes had been used excessively to control vehicle speed during the descent. Although trailing motorists could not have seen illuminated brake lights on the semitrailer because its electrical light system was inoperative, these witnesses did smell an odor they associated with overheated brakes. This odor was detected about a mile before the truck began to accelerate. Since the brakes had no effect on slowing his vehicle when the truckdriver applied them as hard as he could near the point where uncontrolled acceleration began, the truck brakes must have been used excessively for speed control before this point and must have been on the verge of complete fade or faded; otherwise, the truckdriver would have been able to stop the vehicle. Therefore, the Safety Board concludes that the truck was not being operated in second-low range but was being operated at a higher gear setting that would have imposed an excessive braking requirement for speed control.

<sup>1/</sup> Second-low range would have been totally inappropriate because it would have rendered the vehicle a slow-moving hazard. The vehicle could not have achieved a speed of more than 15 mph in this gear setting.

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The Safety Board studied higher gear settings to determine their potential for causing functional truck brakes to fade under the excessive weight. Second-high range and third-low range, the next two successive gear settings above second-low range, would not have required extensive braking for speed control, and the truck brakes would have been able to stop the truck and semitrailer when applied.

In third-high range the truck would have typically traveled at 30 to 40 mph, but could have been operated at 20 mph. This gear setting would have been acceptable for descending the grade if both the truck and semitrailer had adequate brakes. Speed control could have been maintained at the general speed limit, and the truck would not have been a slow-moving hazard. However, with the excessive weight and at any of the reported road speeds, the truck brakes would have been used at an average rate of 100 percent of their capacity even before the truck had entered the steeper 8-percent section of grade where it began to accelerate. This use would explain the odor of overheated brakes 1 mile before the truck began to accelerate. The steeper section of grade would have imposed a braking requirement that was at least 30 percent higher than the truck brake capacity. The use of third-high range on this combination vehicle with inoperative semitrailer brakes would have produced truck brake failure.

The truckdriver inferred that some element of the driveline from the engine to the rear wheels had disengaged by itself and that this disengagement led to uncontrolled acceleration of the vehicle. The Safety Board realizes that the truck could not have accelerated in the manner in which it did unless some element of the driveline had been disengaged, but the truck brakes would also have to be on the verge of fade, or faded, before the driveline was disengaged. While there was evidence that the rear axle had been disengaged as the truck began to accelerate, no evidence was found to indicate that the rear axle, or any other component within the driveline system, disengaged by itself.

In view of the evidence, the Safety Board concludes that the truck was being operated in third-high range, which was a normally acceptable gear setting for the descent. However, the use of third-high range on this vehicle with inoperative semitrailer brakes caused the truck brakes to fail. The Safety Board further concludes that the loss of braking effectiveness rather than driveline disengagement initiated the events leading to uncontrolled acceleration of the vehicle. When he recognized that his brakes were failing, the truckdriver probably did apply the truck brakes and parking brake, as he said, but without effect. The parking brake would have had no effect on slowing the vehicle because it was not designed for that purpose. After applying the parking brake, the truckdriver either knowingly or unknowingly attempted to shift to a lower gear to increase engine braking, but was not successful. Such a maneuver would have been risky and its probability of success low. When he failed to re-engage the gears, engine braking force was lost and the truck accelerated to a speed too fast to negotiate the curve.

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### Motor Vehicle Inspection

In this case, the carrier, the truckdriver, and Federal regulatory authorities were responsible for the safe operation of this vehicle. Because of the condition of the semitrailer brakes, it should have been obvious, even to an unskilled person, that the semitrailer should not have been operating on the highways. Inept vehicle maintenance performed by the construction crew produced the unsafe semitrailer. Inadequate company maintenance policies and procedures provided no effective methods to prevent or correct this inept maintenance. Since company equipment was predominantly en route to and from a job site or at a job site, most equipment repairs would have been necessary while the vehicles were on the road. The construction foremen were made responsible for insuring that the vehicles were in safe operating condition and that proper repairs were made. However, the mechanical condition of this semitrailer indicated that this foreman should not have been charged with this responsibility and that there was no active company policy or procedure whereby the mechanical condition of vehicles would be periodically assessed.

Federal vehicle inspection programs exist to insure that trucks and trailers of the type involved in this accident are being maintained in safe operating condition. These programs are based on the premise that vehicle owners cannot detect or choose not to voluntarily correct unsafe vehicle conditions. The BMCS has conducted random roadside equipment inspections and safety compliance surveys at owner terminals for many years in an effort to insure that interstate vehicles are in safe operating condition. One purpose of a terminal survey is to insure that the owner has established and is using an adequate inspection and maintenance program for vehicles. However, as the Safety Board has noted in two investigations and annual reports, the number of inspections possible by BMCS personnel is extremely limited by the lack of adequate resources and broad program area responsibilities. 2/

This lack of resources was also pointed out by a Comptroller General's report to Congress which noted that the BMCS was able to inspect less than 1 percent of the estimated 4 million interstate commercial vehicles and there was only 1 inspector for every 32,000 of these vehicles. 3/

- 2/ "Highway Accident Report -- Long Transportation Company Tractor-Semitrailer Collision With Multiple Vehicles, Valley View, Ohio, August 20, 1976," (NTSB-HAR-77-3);  
"Highway Accident Report -- Tractor-Semitrailer/Schoolbus Collision and Overturn, Rustburg, Virginia, March 8, 1977," (NTSB-HAR-78-1).  
"National Transportation Safety Board Annual Report to Congress," 1975 and 1976.
- 3/ Report to the Congress by the Comptroller General of the United States, May 6, 1977: "The Federal Motor Carrier Safety Program: Not Yet Achieving What the Congress Wanted."

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Since there is no Federal procedure to provide BMCS with the identity of all those individual operations involved in interstate commerce, no adequate systematic method to conduct safety surveys at owner terminals can be developed. As a result, BMCS cannot insure safe operating interstate vehicles.

The Safety Board has recommended that the U.S. Department of Transportation (DOT) and BMCS seek additional resources and give added priority to roadside and terminal inspections of vehicles already in operation. <sup>4/</sup> These recommendations are applicable to preventing this accident. The BMCS has recently placed additional emphasis on vehicle inspections and terminal surveys within existing resources and is currently seeking additional resources to expand these activities.

This accident report is also the second report in which the DOT and the BMCS have been advised that some procedure is needed to inform BMCS of the identity of all carriers, vehicles, and drivers under its jurisdiction. <sup>5/</sup> Further, the Safety Board has recommended that the BMCS revise its enforcement policy, which is established by Part 222 C of the Interstate Commerce Commission Act, and which now precludes the filing of charges against drivers and carriers who violate the FMCSR unless they have been personally served with a copy of these regulations and knowingly and willfully disregarded them. This enforcement policy should be revised to permit the filing of charges for violations under severe circumstances such as preventable, fatal highway accidents. Because of the serious lack of compliance with the letter or intent of the FMCSR by this company, the BMCS should maintain strict surveillance of the company's compliance with these regulations.

The Safety Board will continue to vigorously seek the implementation of programs by the BMCS that are responsive to Safety Board recommendations for insuring safe operating commercial motor vehicles.

Before this accident, no vehicle inspection program for trucks and trailers existed in the State of Alabama. On February 15, 1978, the Alabama Public Service Commission began a program of roadside and terminal inspections for inter- and intra-state carriers. Alabama is also reviewing the feasibility of periodic motor vehicle inspection for all vehicles.

#### Escape Routes for Out-of-Control Vehicles

There were no escape routes provided for out-of-control vehicles along this downgrade. Escape routes seem unable to consistently compete with other safety improvement projects on a cost-benefit basis. Therefore,

<sup>4/</sup> Ibid.

<sup>5/</sup> "Highway Accident Report -- Tractor-Semitrailer/Schoolbus Collision and Overturn, Rustburg, Virginia, March 8, 1977," (NTSB-HAR-78-1).

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even though the geometric character of a grade may indicate a potential for out-of-control or runaway vehicle accidents, escape routes may not be provided. Specially funded Federal programs have been established for grade crossings, off-road hazard clearance and other similar projects. These programs insure some upgrading of locations where there is a potential for severe accidents but where improvements may not be justified in strict cost-benefit terms. The Safety Board believes that the feasibility of developing a similar approach for providing escape routes should be investigated.

In a previous accident report, the Safety Board recommended that the FHWA establish a design policy that would prevent further construction of long and/or steep highway grades that have the potential for generating runaway vehicles unless escape routes were to be provided. <sup>6/</sup> The FHWA has developed preliminary standards regarding how to design escape routes, but to date, no design policy of the type recommended by the Safety Board has been established. The Safety Board continues to believe that such a design policy is necessary and will vigorously pursue its establishment.

#### CONCLUSIONS

##### Findings

1. The brakes of the semitrailer were inoperative.
2. The inoperative semitrailer brakes produced a weight overload on the truck brakes that seriously degraded the capability of the combination vehicle to descend the grade in a normally acceptable gear setting.
3. The truck was not being operated in second-low range before it began to accelerate as claimed by the truckdriver.
4. No evidence was found to indicate that any component within the driveline system disengaged by itself as claimed by the truckdriver.
5. The truck was probably being operated in third-high range before the combination vehicle began to accelerate, which was a normally acceptable gear setting for the descent.
6. The use of third-high range on a vehicle with inoperative semitrailer brakes caused the truck brakes to fail and loss of braking effectiveness led to uncontrolled acceleration of the vehicle.

<sup>6/</sup> "Highway Accident Report -- Francisco Flores Truck/Pickup Truck With Camper and Trailer Collision, U.S. Route 395, Bishop, California, June 29, 1974," (NTSB-HAR-75-5).

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7. Because of the condition of the semitrailer brakes, it should have been obvious, even to an unskilled person, that the semitrailer should not have been operating on the highways.
8. The inoperative semitrailer brakes were the result of inept vehicle maintenance performed by the construction crew.
9. Inadequate company maintenance policies and procedures provided no effective methods to prevent or correct this type of maintenance.
10. Because of a lack of adequate resources and limited ability to identify interstate carriers, there can be no adequate BMCS effort to insure safe operating interstate vehicles.
11. Because of the serious lack of compliance with the letter or intent of the FMCSR by this company, the BMCS should maintain strict surveillance of the company's compliance with these regulations.
12. The feasibility of specially funded programs to provide escape routes for out-of-control vehicles along already constructed grades should be investigated.
13. To date, there is no adequate national design policy that would prevent further construction of long and/or steep highway grades that have a potential for generating runaway vehicles without providing escape routes.

#### Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the loss of braking effectiveness which permitted the truck-semitrailer to accelerate out-of-control down a long, steep grade. The loss of braking effectiveness was caused by inoperative brakes on the semitrailer, which resulted from inept and inadequate maintenance and by the operation of this unsafe vehicle.

#### RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board made the following recommendations:

-- to the Federal Highway Administration:

"Establish a procedure that will serve to identify all carriers, vehicles, and drivers under Federal Highway Administration jurisdiction. (Class II, Priority Action) (H-78-40)

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"Establish a procedure that will serve to inform all carriers and drivers under Federal Highway Administration jurisdiction of their responsibilities in regard to the Federal Motor Carrier Safety Regulations. (Class II, Priority Action) (H-78-41)

"Maintain strict surveillance of the Ford Construction Company's compliance with the provisions of the Federal Motor Carrier Safety Regulations. (Class I, Urgent Action) (H-78-42)

"Investigate and report to the Safety Board on the feasibility of specially funded Federal programs to provide escape routes for out-of-control vehicles along already constructed grades where there is a potential for out-of-control accidents but where escape routes are not justified in strict cost-benefit terms. (Class II, Priority Action) (H-78-43)

"Expedite action to establish a design policy that would prevent further construction of long and/or steep highway grades that have the potential for generating runaway vehicles without providing escape routes. (Class I, Urgent Action) (H-78-44)"

The Safety Board also reiterates the recommendation that it made in Highway Accident Report NTSB-HAR-78-1:

"Revise its enforcement policy which now precludes the filing of charges against drivers and carriers in violation of the Federal Motor Carrier Safety Regulations unless they have previously been served with a copy of the safety regulations, to permit the filing of charges for violations under severe circumstances such as preventable, fatal highway accidents. (Class I, Urgent Action) (H-78-12)"

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING  
Chairman

/s/ FRANCIS H. McADAMS  
Member

/s/ PHILIP A. HOGUE  
Member

/s/ ELWOOD T. DRIVER  
Member

May 4, 1978

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